

# Discussion of WHFS

## Point Display Control Feature

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In Build 5.1.1., the point display feature in WHFS was completely replaced with a new, more comprehensive, more flexible, and more efficient package. The point display feature refers to the WHFS function located in the HydroView application which provides display of point data for specific locations. The point data displayed generally consists of one value per station; in that sense, the feature comprises a many station, single value mode of operation. This is in contrast to its complement function, the Time Series Viewer, which provides data in a single station, multi-value mode.

The new method recognizes and exploits the SHEF-based structure of the data in the database. The control over the data selections is based on selecting the data as per its SHEF attributes. These include the physical element (PE), duration (instantaneous or XX hours), type-source (TS), and the extremum (minimum or maximum).

This document discusses the new features of the point display, then presents a detailed discussion of the interface used to control the features. It then provides a few miscellaneous notes, followed by a description of the application tokens used by the point control function, and concluding with a bulletized list of possible future enhancements. This document will serve as the basis for a more comprehensive, more formal user information to be published at a later time.

### **Summary of Enhancements:**

*All PEs can now be plotted:*

In addition to the previously available selections for displaying Height, Rain, Snow, and Temperature data, the user can now select any of the other 12 observational PE data tables. These other 12 tables are: Agricultural, Evaporation, Ground, Ice, Lake, Moisture, GateDam, Pressure, Radiation, Weather, Wind, and Yunique. In addition, the Discharge data are grouped with the Height data to form a new class of data termed River data.

*Greatly increased control over which PE-TS is used:*

Formerly, one had little control over which PE and TS are considered/used when selecting either one for the River, Precip, Snow, or Temperature. For example, selecting Snow and Temperature only supported the PEs of SW and TA only, respectively; selecting Precipitation used the best PE-TS value based on hours covered, and selecting height data used the best PE-TS based on

primary pe and ts-rank settings, but limited the display to only the best. Now, for any data type, the user can explicitly select which PE-TS to use, or can use the best feature for Precipitation data, or the ts-rank feature for other elements, to let the program decide which TS of the given PE to use.

*Greatly increased control over which time reference is used:*

Formerly, only the latest value was available for most data. Precipitation data was the exception in that it allowed control over the ending time. Now the user can select additional time references. Specifically, a set ending time can be specified for any element, and the user can also request the min or the max over some set number of hours.

*Min/max data can be selected:*

Previously, data explicitly labeled as minimums or maximums could not be plotted. Now the SHEF extremum attribute associated with each value is used. This attributes can denote a value as being a minimum or maximum, and the duration over which it is considered a minimum or maximum (i.e. 24 hours).

*New tabular feature and linkage to time-series:*

Previously, the user could specify options regarding which data to display, and the data could be displayed in geographic form only. The new GUI will allow the same data to be tabulated, from where it can be saved and/or printed, or the user can invoke the time-series display to view the entire time-series for the given lid-pe-ts. Conceptually, the time-series and point display work in a complementary fashion, where time-series gives many times for a single lid-PE-TS-etc., while a point display will give many lid-PE-TS-etc. for a single time.

*Improved retrieval performance:*

The manner in which the data are retrieved was optimized to greatly increase retrieval times for certain requests. For retrievals of the latest data for all but River and Rain data, this method will get data from the LatestObsValue table if the shef\_post\_latest token is set; this retrieval method is very fast. If the token is not set, then these retrievals will extract data from the PE tables, as was done in the previous implementation, and which is not as fast. For retrievals of the latest River data, the query is rather quick because the retrieval is from the RiverStatus table. For Rain data, the retrieval is from the CurPrecip table, as was done in the previous implementation. For requests for data that is not the latest data, the retrievals are always from the PE tables.

Regardless of which table is read, the new implementation uses a faster strategy for getting the data. This method is centered around the strategy of getting all data with one query, then having the program extract the necessary info, as opposed to the former method of looping on each location, and attempting to extract data for each station separately.

Another manner in which the new implementation is faster is that now the data are only retrieved when necessary; in other words only when some criteria for retrieving data, such as the ending time, was changed. If the user simply wants to turn the icons off, or filter the stations, there is no need to retrieve the data, as was done in the previous implementation. The GUI controls which do NOT affect the retrieval process are grouped in the bottom of the point control window, below the Map Data and Tabulate Data pushbuttons

*Supports service backup filtering:*

An additional criteria for filtering data is provided. The user can filter stations based on the service area assignments defined for a station.

*Map Plots Consider Data Precision:*

When displaying the numerical values on the geographical displays, the number is shown with the appropriate number of significant digits (i.e. to the right of the decimal point) for most data types. For the other data types, the default of two digits to the right (i.e. hundredths) is used. This recognition of the precision makes certain plots more readable, such as those for temperature, which only uses whole numbers.

*Icon Display Control Simplified:*

There no longer is an option to control icon-only displays independent of the data display control. This feature unnecessarily cluttered the GUI control. The new GUI allows the user to toggle icons and data at their discretion, so icons-only displays can still be generated if desired. The new paradigm is that data are requested and the stations which have, or which are expected to have, that data are displayed. The old paradigm in which stations types are selected, and then data for the stations are retrieved, has been replaced.

As part of this change, one feature no longer available is the means to display icons for undefined stations. Also, the user no longer can display reservoir stations explicitly. One can display data typically found for reservoirs (e.g. HP, HT data).

Icon shapes for stations are still based on the entire suite of data expected for the station, whether it include river data, reservoir data, general meteorological data, and whether the station is an official forecast point.

*Missing data can be suppressed for any element:*

Previously, the suppress missing options was available only for precip data. Now it can be done for any display.

Point Data Control

☒ River  
☐ Rain  
☐ Snow  
☐ Temp  
☐ Other

Agriculture  
Evaporation  
Ground  
Ice

Primary  
HA Reac  
HB Dep  
HC Ceil  
HD Heac  
HE Regu  
HG Rive  
HI Stag  
HO Floc  
HP Pool  
HT Tail

☒ TypeSrc  

RG	GOES
RP	Phone
RV	Visual
RZ	Nonspe

☒ Latest
☐ SetTime
☐ Min
☐ Max

2001-02-21 16:00

Hrs: 24

Tabulate Data

Map Data

Filter:
☐ Data Source
☐ Service Area...

Observer  
DCP  
ALERT

Suppress:
☐ Msg  
☐ Zeros  
☒ Non-FcstPts

River Basis:

Max

☒ Non-FcstPts

Map:
☒ Val
☒ Id
☐ Name
☐ Time

Value

☒ Icon

Close

## **GUI Control:**

A completely new control window is provided to manage the selection and subsequent display of the point data. The new GUI window, shown on the previous page, is described below. The description is given in terms of the primary parts of the window.

### **Part 1. Select data type to use.**

#### **A. Specify primary element**

This radio box selection dictates which PE table(s) to use to display data. The four explicit choices are River, Rain, Snow, and Temperature. The River item includes both the Height and Discharge tables. Note that when retrieving Precipitation data, the data are retrieved from the CurPrecip database table, not the Precip table.

An additional entry of Other is provided for the remaining elements. When this is selected, the single-select scroll list associated with the Other selections lists the dozen remaining elements that can be selected (Agricultural, Evaporation, Ground, Ice, Lake, Moisture, GateDam, Pressure, Radiation, Weather, Wind, Yunique). When the shef\_procobs token is OFF, an additional item is also available in this list: Processed . In this case, the list will have 13 items.

Whenever the primary element is selected, the PE and TS scrolled lists are updated (see below).

#### **B. Select specific physical element (PE)**

For the selected primary element, this list gives the unique SHEF-based PE entries available in the database table(s) associated with the selected element, as defined by the IngestFilter. For River, an additional item is listed ( Primary ) that instructs the program to use the primary PE defined for the river characteristics in the station. For Precip, an additional item needs to be listed ( PC and PP ). This instructs the program to use the best value among the candidate PC and PP values.

#### **C. Select specific type-source (TS)**

For the selected element and given PE, this list gives the unique SHEF-based TS entries as defined via the IngestFilter. This is updated when the user selects a different PE. There is a toggle button that indicates whether the program should consider the TS when processing the request. If the toggle is set on, then only one TS can be selected. If the toggle is set off (i.e. don't limit to a given TS), then in the event of two values available for a given lid-PE combination, the one with the highest ts-rank will be displayed. The ts-ranking rule does not apply for Precip data; for Precip data, the PE-TS combination

which has the most data, in terms of number of hours covered, is used. The TS list is not displayed when requesting River data for the Primary PE.

#### Notes:

Selectability/specificity: The primary key for the observed PE tables is: lid, pe, dur, ts, extremum, obstime and the key relates to the point control as follows. All lids are used, and one specifies the PE(s) to use. The duration is ignored, except for precip data which uses it of course. The TS is either explicitly specified or the ts-ranking is used. The obstime is definitely considered, as discussed below. Lastly, only the daily min and max extremum codes are considered.

Available data choices: Because the GUI uses the IngestFilter to populate the PE and TS lists, note that the lists will include ALL possible entries, not just those entries that are within the database. This will allow much quicker response when loading these lists, since the actual PE table need not be queried. It allows the option to display data as MISSING, in the event that a location should have data in the database table but doesn't.

## Part 2. Select data time reference

The time window for which data is retrieved depends on the value of the 3 time reference fields, all of which work together to determine the time window and the manner in which the time window is used. These three fields are described below.

### A. Time mode

The time mode is specified as either: the latest time, a set time, the minimum, or the maximum.

When `latest` is selected for non-Rain requests, the program only considers data that are within the last N hours, where N is the hours value defined in the GUI (mentioned below). For precip requests, the top of the latest hour is used, and the N value gives the duration.

When `set time` is selected for non-precip requests, the program looks for data in the time window defined by the (center) time +/- N hours. For precip requests, the end time is used, and the N value gives the duration.

When `min` or `max` is selected, the program looks for data with the min or max (as selected) SHEF-based extremum code for the selected duration. The following durations are supported (the min and max codes, respectively are shown in parentheses): 1 hour (F, D), 3 hour (G, E), 6 hour (H, R), 12 hour (P, Y), 18 hour (I, S), 24 hour (N, X), one-week

(M, W). If a duration is given that does not match one of these durations, then the next lowest SHEF duration is used. For example, if 11 hours is given, then a duration of 6 hours is assumed. The time window for which it looks for the min or max with the selected duration ends at the specified ending time, and begins at the ending time minus the duration \* 1.5. For example, if the ending time is 18Z, and the duration is 6 hours, and the requested data is the minimum, then the application looks for data from 9Z (=18-6\*1.5) to 18Z, with a extremum code of H .

Note that there is no support for time modes of latest, min, or max when doing precipitation retrievals. The set time value is always used.

#### B. Ending/Center time

This multi-purpose field is used for all but the latest time reference option in a manner described above. The time defaults to the top of the most recent hour. Arrow buttons allow adjustment of the time by hour or day increments, or the user can manually enter a time.

#### C. Hour

This multi-purpose field takes on different meaning depending upon the time reference option. See above for details.

### Part 3. Actions

The user can either display the data on a map, or the data can be displayed in tabular fashion. The retrieval of data is determined by the user controlled options specified in Parts 1 (Data to Use) and Parts 2 (Time Reference) of the window. The options given in Parts 4 and 5 affect how the data are filtered and presented to the user.

### Part 4. Select station filter

In Part 1 and 2 of the GUI, the user can control what data are to be considered for display. Part 4 allows the user to control which stations are to be considered from the set of data produced as per the instructions in Parts 1 and 2..

#### A. Data Source Filter

This station filter is specified by either the station's data source(s) or its service area assignments. Both the data source and the service area filter can be turned on and off via a toggle button. When turned on, the station is checked to see whether it has defined a

source one or more of the selected data sources, or whether it meets the service area criteria, respectively.

The possible data sources are either: Observer, DCP, or Telemetry Type. A station is considered to have an Observer or DCP as one of its source if it has an entry defined in the Observer or DCP tables, respectively. The telemetry type is defined in the Telem table. The information about a station's data sources which is used by this filter is contained in the StnClass database table.

## B. Service Area Filter

The station filter is specified by either the station's data source(s) or its service area assignments. Both the data source and the service area filter can be turned on and off via a toggle button. When turned on, the station is checked to see whether it has defined a source one or more of the selected data sources, or whether it meets the service area criteria, respectively.

Each station is located in a county, which in turn has three offices defined for it: the responsible WFO, the primary backup WFO, and the secondary backup WFO. The application allows filtering by service area to be applied or not, and if it is applied, allows filtering to be defined for any or all of the three service levels. Within each service level, the user can specify one or more WFOs; the application requires the station to match at least one of the selected offices (i.e. it applies a logical OR). If filtering for multiple service levels (e.g. by responsible WFO and secondary WFO), then the given station must satisfy both user-defined filters for the multiple service levels (i.e. it applies a logical AND). For example, if the user specifies a filter criteria of two responsible WFOs and three secondary WFOs, then a station is only considered (i.e. not filtered out) if it matches one of the selected responsible WFO choices, and one of the secondary choices.

## C. Suppress Missing/Suppress Zeros/Suppress Non-Fcst Points

The filter also allows suppression of missing values and/or suppression of zero values and/or non-forecast points. The suppression of zeroes is typically only useful for Rain data requests.

When adding missing entries, the application uses the information in the IngestFilter table, to determine which station should be there, and for those stations which do not have a value, a missing entry is appended to the list of data. One interesting implication of this is that if suppressing non-forecast locations and not suppressing missing data, then one might expect to see all forecast points. However, if for a given data type, a forecast point has no data, as indicated by the IngestFilter entries, then a missing report will NOT be listed for the forecast point location. Because adding missing data requires a query of the IngestFilter table, note that including missing table takes



slightly more time than suppressing missing data.

If data are found for an area id, for which no location information is defined, then the value is filtered out automatically. When filtering data, stations that have the no-post switch are ignored.

## Part 5. River Basis and Map Options

### A. River Basis

This option applies to both tabular and geographical displays. For displays of river data, the user can specify whether to use the latest observed, the maximum forecast, or the maximum of the two. This option applies to both tabular and geographical presentations. Note that the stage basis only applies for the time mode option of Latest.

### B. Map Options

These options only apply to the map display. At most, for each location, the map display shows 1) the icon, 2) the value, 3) the time, 4) the location id, 5) the location name, 6) and possibly second value for the flood stage. The user can toggle the display of the first 5 items. When turning off the display of the value, the display of any second value is also turned off.

Also, for river data, the value can be either the value itself or it can be the departure from the flood level. This option is only meaningful for geographical displays; for tabular displays, both sets of values are always shown.

## Additional Notes:

When selecting tabulate or map data, the application does NOT normally re-retrieve the data if no data options have changed (i.e. those options located above the tabulate and map buttons). If the refresh time has passed (e.g. 15 minutes) then a new retrieval is always performed when selected in the tabulate or map buttons, regardless of whether any option have been changed. Avoiding unnecessary retrievals of data is very helpful in improving the performance of the application. If non-data options are changed, such as the filter options and data display options located below the tabulate and map buttons, there is no need to re-retrieve the data.

When invoking the time-series from the tabular listing, there are times when an exact match for the PE-TS-DUR-EXTREMUM key is not possible. In this case, when the time series (graph or

map) is invoked, the best it can do is to bring up the control window for the given station, without displaying the actual tabular or graphical window. The classic case where this occurs is for precipitation data, which has a duration assigned by the point control function which probably does not match any duration found for a key in the appropriate data records.

The tabular display show the flood level and departure from flood level, if the flood level is available, and if H\* or Q\* data are being displayed. The flood level is given in units of stage or discharge, depending upon the Primary PE designation in the RiverStat table. Also, if the action level is set, then the value is compared to this level. If it exceeds the action level, then the entry in the tabular list for this station denotes that the level was exceeded (>ACTION!!).

### **Tokens:**

The following existing tokens are used by the point control function:

- shef\_procobs - This controls whether the list of other table includes Processed or not, and where to find data with a TS of P\*. If set to ON, then Processed data are co-mingled with observed data, so the other list will not include Processed data, and the TS=P\* data will be expected to be in the applicable PE table.
- shef\_post\_latest - If this is set to ON, then retrievals for Latest data use this data table, which results in retrievals which are much faster.

Three new tokens are provided as part of the point control features:

- hv\_pets - Specifies the initial PE and the optional TS value for which data will be retrieved. The value is either the keyword PRIMARY , PCPP , or <PE>, or <PETS>, where PRIMARY implies the River data type using the Primary PE, PCPP implies the Precip data type using the best PC or PP based value, <PE> is simply a specific physical element value, and <PETS> is a specific PE-TS combination. When specifying the physical element in the <PE> or <PETS> form, only a River, Precip, Temperature, or Snow PE can be given; the other PE values are not recognized for this token. If no token value is defined, a value of PRIMARY is assumed.
- hv\_riverbasis - Specifies the initial setting indicating which type of value is used to base the single, representative value for river values. The possible values are obs , fcst , and maxobsfcst , where obs implies use of the latest observed value, fcst implies use of the maximum forecast value, and maxobsfcst implies use of the maximum of the two. The single value so obtained is used to color the river icon on the main geographic display,

and can also be listed using the tabular fashion. If no token value is defined, a value of maxobsfcst is assumed.

hv\_durhours - Specifies the initial duration in hours that applies to the time window used for the retrievals. The token value is simply a positive integer value. If no token value is defined, a value of 24 hours is assumed.

### **Future Enhancements:**

Enhancements that could be added in the future include, in no particular order:

#### Retrieval Requests:

- Consider adding filters based on the QC state of the data.
- Determine what to do with elements which report non-zero duration data. These can include the following PEs: AD, AT, EP, EV, QI, QT, RI, RP, RT, TA, UL.
- Add the ability to predefine display requests, ala the time series groups.
- Support the computation of derived stage-discharge data.
- Add support for forecast data, beyond the maximum forecast river value currently supported.
- Provide support for treating non-PC,PP data as regular observations (e.g. PN, PT).
- Provide options for user control of auto-accum features in precip computations, als RiverPro.

#### Tabular Display:

- Possible improvements to invoking time series displays for derived point control data which may not have database key match.
- Add a sort button for the tabular listing.
- Provide some sort of legend information.
- Allow display of the PE, TS, Duration, Extremum, QC, and other report attributes on the map. These values are readily available and this function can be easily provided.
- Show the station name, county, and state in the tabular listing.

#### Geographical Display:

- Add a clear button somewhere to allow HydroView users to clear the geographic point display. Currently, the best that can be done is turn off all items such as the value, id, name, time, and icon, or to display data for some obscure data set that has no data.
- Provide some sort of legend information.
- Allow display of the QC and other report attributes on the map. These values are readily available and this function can be easily provided.
- Add support for coloring the icons when displaying precip data. This feature is easily added, given that a known color scale is determined. Also, could color based on the QC status of the

value (i.e. Good, Questionable, or Bad).

Other:

- Determine why HydroView seems to process the data twice in the course of its display request. This is noted by its double-calls to the loadStationPointData() function.